a hyperbolic profile or any similar shape to allow the removal of material from the inner surface for balancing the coupling system **40**.

The undulant flexible section **44** contains the following design parameter variables shown in FIG. **3**:

Ra: Diaphragm outer radius
Rb: Diaphragm inner radius
Ta: Outer radius thickness
Tb: Inner radius thickness
Ro: Outer ring radius
Ri: Inner ring radius
Rs: Shaft/diaphragm fillet radius

In one embodiment, the above variables are used to manufacture the undulant flexible section **44** with the following design parameters:

$Rb/Ra<0.6$

$2<Tb/Ta<3.5$

$Ri>2*Ta$

$Ro>2*Ri$

$Rs>2*Tb.$

The above design parameters allow integral coupling system **40** of an epicyclic gear train the ability to accommodate the combined axial, lateral, and angular misalignments common for such systems while simultaneously allowing for the transfer of torque in the system. Integral coupling system **40**, through the non-symmetric tapered contour profile, isolates the spline system from the helical sun gear misalignment. The integral coupling system **40** primary control design parameters are the thickness and radii ratios as listed. The set of diaphragms as illustrated in FIG. **2** can be of different radial dimensions to isolate the spline system from the epicyclic gear train excursion and shaft system misalignment. Thus, the overall system is improved in reliability because the propensity for spline wear to occur is remote, and the epicyclic gearbox has the ability to operate under misalignment.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

The invention claimed is:

1. A planetary gear train driven by a shaft, the planetary gear train comprising:

a sun gear with an integral coupling;

a ring gear; and

a plurality of planet gears rotatably mounted in a planet carrier and meshing with the sun gear and the ring gear;

wherein the with the integral coupling connects the sun gear to the shaft, with the integral coupling having at least one undulant flexible section joined to a spindle for accommodating misalignment between the sun gear and the shaft, wherein the undulant flexible section contains two parallel interior walls which are generally perpendicular to a central axis of the shaft and which are joined by an outer ring member; and

wherein the at least one undulant flexible section further comprises an outer radius Ra with a corresponding outer radius thickness Ta, an inner radius Rb with a corresponding inner radius thickness Tb, an outer ring radius Ro, an inner ring radius Ri, and a shaft fillet radius Rs, and wherein the at least one undulant flexible section has the following design criteria:

$Rb/Ra<0.6$

$2<Tb/Ta<3.5$

$Ri>2*Ta$

$Ro>2*Ri$

$Rs>2*Tb.$

2. The planetary gear train of claim **1** wherein the sun gear comprises a gear portion with a shaft portion extending concentrically therefrom.

3. The planetary gear train of claim **1** wherein an outer wall corresponding to each parallel inner wall forms a hyperbolic cross-sectional profile.

4. The planetary gear train of claim **1** wherein each outer ring member contains an interior surface that is generally perpendicular to the parallel wall, and an exterior surface that is hyperbolic in cross-section.

5. The planetary gear train of claim **1** wherein the undulant flexible section contains an oil drain aperture.

6. A planetary gear train driven by a shaft, the planetary gear train comprising:

a sun gear;

a ring gear;

a plurality of planet gears rotatably mounted in a planet carrier and meshing with the sun gear and the ring gear; and

a sun gear coupling connecting the sun gear to the shaft, the sun gear coupling having at least one undulant flexible section joined to a spindle for accommodating misalignment between the sun gear and the shaft, wherein the undulant flexible section contains two generally parallel interior walls which are generally perpendicular to a central axis of the shaft and which are joined by an outer ring member; and

wherein the at least one undulant flexible section further comprises an outer radius Ra with a corresponding outer radius thickness Ta, an inner radius Rb with a corresponding inner radius thickness Tb, an outer ring radius Ro, an inner ring radius Ri, and a shaft fillet radius Rs, and wherein the at least one undulant flexible section has the following design criteria:

$Rb/Ra<0.6$

$2<Tb/Ta<3.5$

$Ri>2*Ta$

$Ro>2*Ri$

$Rs>2*Tb.$

7. The planetary gear train of claim **6**, wherein the sun gear is welded to the sun gear coupling to form a single structure.

8. The planetary gear train of claim **6** wherein the sun gear comprises a gear portion with a shaft portion extending concentrically therefrom.

9. The planetary gear train of claim **6** wherein an outer wall corresponding to each generally parallel inner wall forms a hyperbolic cross-sectional profile.

10. The planetary gear train of claim **6** wherein each outer ring member contains an interior surface that is generally perpendicular to the generally parallel wall, and an exterior surface that is hyperbolic in cross-section.

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